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Development in multiple areas of life in adolescence: Interrelations between academic achievement, perceived peer acceptance, and self-esteem

Julia Tetzner,[1] Michael Becker,[1,2] and Kai Maaz[1]

Abstract

This study examined interrelations between three indicators of main challenges during adolescence: academic achievement, self-perceived peer acceptance, and self-esteem. An additional aim was to investigate whether the findings hold for girls and boys and across school types (academically oriented track vs. non-academically oriented track). We used a large German longitudinal study (N = 7,977; mean age at t_1 = 13.5 years) with three measurement points over a period of four years (start of seventh grade, end of seventh grade, end of tenth grade). Cross-lagged panel and multi-group models revealed seven main findings: (1) We found general positive associations between academic achievement, perceived peer acceptance, and self-esteem. (2) Higher academic achievement predicted higher self-esteem, but not vice versa. (3) Self-esteem and peer acceptance showed mutual associations, but only in older adolescents between the end of seventh and end of tenth grades. (4) Peer acceptance slightly predicted lower levels of academic achievement in students on the non-academically oriented track. (5) The results held for both girls and boys, but (6) changed over the course of adolescence and (7) differed between school types. Taken together, our findings offer comprehensive insight into the relations between salient developmental tasks in adolescence.

Keywords

Academic achievement, self-esteem, perceived peer acceptance, longitudinal study, cross-lagged panel model

Adolescence is a life period that incorporates extensive and simultaneous challenges and changes in different areas (Masten, Obradović, & Burt, 2006): adolescents must manage increasing academic demands, fundamentally rearrange their relationships with parents and peers, and develop their selves and identities. Several theories and empirical findings address how the developments in different areas are connected, mainly indicating mutual positive relations (e.g. Havighurst, 1972; Reitz, Motti-Stefanidi, & Asendorpf, 2016) prone for developmental changes (Juvonen & Knifsend, 2016). Although scholars have long recognized the influence of environments (Bronfenbrenner, 1979), little is known about whether and how different contexts alter these connections. This study aimed to contribute to the current knowledge about these issues by investigating mutual relations between academic achievement, perceived peer acceptance, and self-esteem over four years from early to middle adolescence. We further expanded this focus on intra-individual development with an environmental perspective by examining the influence of different school types and genders.

Development During Adolescence

In his framework, Havighurst (1972) defined salient developmental tasks for each life period that arise from societal expectations, physical processes, and personal goals. He regarded the accomplishment of each task as an indicator of present developmental success and the foundation for positive future development (Roisman, Masten, Coatsworth, & Tellegen, 2004). Recently, scholars have emphasized the developmental task approach as a useful framework for investigating development across the life course (see Hutteman, Hennecke, Orth, Reitz, & Specht, 2014). Age-salient tasks during adolescence include adaptations in three broad domains of functioning: academic, social, and individual development (see also Havighurst, 1972; Sroufe, Egeland, Carlson, & Collins, 2005; Masten et al., 2006). The accomplishment of these tasks may represent milestones for adolescents (e.g. Roisman et al., 2004) with meaningful implications for adjustment in adulthood (Orth, Robins, & Widaman, 2012; Rubin, Bowker, McDonald, & Menzer, 2013; Spinks et al., 2007).

Researchers and laypersons agree that academic education is a major task during adolescence. Early adolescents must manage the transition into secondary school with rising differentiations of subjects and increasing demands (Eccles et al., 1993). How adolescents adjust to these challenges and, correspondingly, how well they perform academically affects what opportunities will be open to them (e.g. Spinks et al., 2007). Another major concern of adolescents is relationships with their peers (Parker, Rubin, Earth, Wojslawowics, & Buskirk, 2006; Wentzel, 2014). Social environments

[1] German Institute for International Educational Research, Frankfurt a.M./Berlin, Germany
[2] Leibniz Institute for Science and Mathematics Education, Kiel, Germany

Corresponding author:
Julia Tetzner, German Institute for International Educational Research, Warschauer Straße 34–38, Berlin 10243, Germany.
Email: tetzner@dipf.de

are important contexts that influence how individuals behave and what they feel and think (James, 1890). Entering adolescence, individuals gradually shift from perceiving their parents and families as their main social relations toward forming a greater attachment to peers (Brown & Larson, 2009). Adolescents become more concerned with being accepted by their peers than they do as children or adults (Brown, 2011), and influences associated with peers gain in importance for developmental processes during adolescence (Harter, 2012). As a third main concern, Erikson (1968) referred to adolescence as the stage in which individuals reexamine and explore their identities. Driven by maturational changes, adolescents' self-views become increasingly differentiated (Harter, 2012). As a main part of self-views, self-esteem (defined as the overall value people place on themselves; Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995) changes substantially. Recent research has mainly indicated that self-esteem increases from early to late adolescence (Erol & Orth, 2011), but it has also revealed notable interpersonal variability in developmental trajectories (Zimmerman, Copeland, Shope, & Dielman, 1997). In the following, we address the specific concepts of academic achievement, perceived peer acceptance, and self-esteem to refer to these three broad domains of functioning during adolescence.

Connecting Different Areas of Adaptation During Adolescence

Several theories provide ideas about causal connections between academic achievement, perceived peer acceptance, and self-esteem. From a meta-theoretical point of view, a holistic-interactionistic (or systemic) perspective (Cicchetti & Curtis, 2007; Magnusson & Stattin, 2006; Thelen & Smith, 2006) assumes that ongoing processes are at play between psychosocial (e.g. self-esteem) and behavioral components (e.g. academic achievement) within the individual. This perspective, therefore, predicts longitudinal developmental connections. Ecological approaches additionally emphasize the role of contextual influences (Bronfenbrenner, 1979) and the lifespan perspective (Baltes, Lindenberger, & Staudinger, 2006) states that the kind and strength of developmental connections and contextual influences can change as a function of time and developmental state. Taking these theoretical assumptions together, associations between academic achievement, perceived peer acceptance, and self-esteem are conceivable, but may change over the course of adolescence and differ between adolescents in different contexts such as peer groups or educational institutions. For the purpose of shedding more light on these relations, this paper presents theories and empirical evidence that connect these constructs during adolescence. We further refer to how and why mutual relations may change as a function of contextual influences.

Self-esteem as Cause or Consequence of Peer Acceptance and Academic Achievement

Sociometer theory (Leary & Baumeister, 2000) proposes that self-esteem is an internal monitor for social acceptance or rejection. Accordingly, self-esteem decreases during experiences in which a person feels socially excluded and increases during experiences in which he or she feels included. Similarly, academic achievement may also affect adolescents' self-esteem because it constitutes a developmental outcome that may prompt feedback from parents, teachers, and peers. Social feedback from peers and teachers may be especially powerful during adolescence when the need for identity formation (Erikson, 1968) comprises the challenge of integrating different information about the self into a global self-view. In light of the rising significance of peer relationships during adolescence (Brown & Larson, 2009), self-esteem may be especially susceptible to social feedback from peers, and this influence may successively increase with progressing adolescence. The *self-broadcasting theory* (Srivastava & Beer, 2005) suggests that the reverse effect may also be true: higher levels of self-esteem may predict social inclusion, as self-esteem may guide individuals to interpret social cues in more favorable ways. High self-esteem may also enhance academic achievement by guiding adolescents to aim high, persist even after failure, and use self-protecting attributional styles (cf. Baumeister, Campbell, Krueger, & Vohs, 2003). Especially during demanding and high-risk periods such as adolescence, a high self-esteem may moreover prevent declines in academic achievement by equipping adolescents to master the multitude of age-associated challenges and to overcome adversities (Swann, Chang-Schneider, & Larsen McClarty, 2007).

Though empirical studies have confirmed both directions, results have mainly supported sociometer theory. Longitudinal research has shown that peer acceptance enhanced adolescents' self-esteem (Birkeland, Breivik, & Wold, 2014; Reitz et al., 2016; Srivastava & Beer, 2005) and thereby that perceived rather than actual acceptance seemed to be the more important factor (Greene & Way, 2005). A recent longitudinal study examined the association between adolescents' self-esteem, their self-perceived acceptance among peers, and their peer-perceived social acceptance (Reitz et al., 2016). They found that peer-perceived acceptance predicted self-esteem, and this relation was mediated by self-perceived acceptance. In turn, self-esteem predicted self-perceived, but not peer-perceived, acceptance. Addressing academic achievement, empirical evidence has also mainly indicated that self-esteem should be viewed as a consequence rather than a resource (Bachman & O'Malley, 1986; Rosenberg, Schooler, & Schoenbach, 1989; Trautwein, Lüdtke, Köller, & Baumert, 2006a). In one study that used three time points during the seventh grade, Trautwein and colleagues (2006a) found evidence that standardized mathematical achievement scores predicted adolescents' self-esteem but only slight evidence for the reversed effect. However, they found prospective effects of self-esteem on grades in German and mathematics.

Linking Peer Acceptance and Academic Achievement

Research also supports links between peer acceptance and academic achievement: Perceiving acceptance by peers is supposed to promote a greater sense of belonging in school and thereby foster school engagement (Juvonen, 2006; Juvonen, Espinoza, & Knifsend, 2012, Furrer & Skinner, 2003). Positive peer relationships may moreover provide greater access to information and resources that help adolescents accomplish academic tasks (Wentzel, 2014). Being rejected by classmates may, in contrast, lead to disengagement and decreasing academic achievement (Buhs, 2005; Juvonen & Knifsend, 2016). Since peers become main social partners in adolescence (Brown & Larson, 2009), they may exert especially powerful influences on school engagement during this life period. In turn, empirical results demonstrated that students generally value high academic achievement by their classmates (Wentzel, Battle, Russel, & Looney, 2010), indicating that the relation between academic achievement and peer acceptance is likely to be reciprocal.

Although empirical findings are mixed (Schwartz, Gorman, Nakamoto & McKay, 2006), they mainly confirmed mutual associations. Results of Lopez and DuBois (2005) indicated that seventh graders who feel rejected by their peers have lower grade point averages than their classmates who feel accepted. In a longitudinal study with fifth graders, Buhs (2005) found that the prediction of academic achievement by peer rejection was mediated by academic self-concept and engagement. Evidence also exists that children and adolescents with poor peer acceptance are at risk for dropping out of school or being absent from school (Parker & Asher, 1987; Lopez & DuBois, 2005). Indications for the reversed relation comes from qualitative research in which adolescents discussed their motivational goals as far as academic achievement; the research emphasized anticipated peer integration as one of the main motives given for school engagement (Dowson & McInerney, 2001). In supporting this assumption, Véronneau Vitaro, Brendgen, Dishion, and Tremblay (2010) found that academic achievement predicted peer acceptance in elementary school children.

However, empirical findings indicate that the association between peer acceptance and academic achievement may change over the course of adolescence and become increasingly negative (Juvonen & Knifsend, 2016). Since school engagement and motivation are commonly known to decline during adolescence, the social value of school engagement and academic achievement in the classroom also becomes increasingly negative (Galvan, Spatzier & Juvonen, 2011). In comparing perceived classroom norms regarding socially accepted behavior and peer acceptance in U.S. elementary and middle schools, Galvan and colleagues (2011) reported that students in elementary schools socially value academic engagement whereas students in middle schools socially value negative social and academic behavior. In conclusion, perceived peer acceptance and academic achievement may (still) promote each other during early adolescence, but this positive reciprocal association may reverse over the course of adolescence.

Schools and Gender as Contextual Influences during Adolescence

In addition to developmental changes, research indicates that contextual differences may also alter developmental relations (Juvonen, 2016; Wentzel, 2014). Scholars therefore consistently emphasize the importance of integrating contexts in the research on developmental processes (e.g. Baltes et al., 2006; Bronfenbrenner, 1979). One important contextual influence specific to adolescence is the selection of students in school tracks that differ in their academic orientations (academic vs. vocational track; Becker, 2009). The academic school track is characterized by higher academic demands and its students by higher academic abilities, motivation, and engagement compared to those on non-academic tracks (Trautwein, Lüdtke, Marsh, Köller, & Baumert, 2006b). Differential academic orientations may create differential classroom norms about the kind of academic and social behavior that is valued positively by students, affecting adolescents' academic and psychosocial development differently (Juvonen & Knifsend, 2016). Hence, students may be more likely to show school engagement and to seek high academic achievement on the academic track where their classmates value academic motivation and achievement more positively. Conversely, students on non-academic tracks may hide their academic motivation and engagement to avoid social exclusion. Findings from a recent cross-sectional study support the influence of classroom norms. In a large sample of Dutch early adolescents, Dijkstra and Gest (2015) found that the academic peer norm salience (i.e., the extent to which students in one classroom associate academic achievement with popular students) moderates the association between self-perceived peer acceptance and teacher-rated academic achievement. Surprisingly, their study indicated no relation between the salience of academic norms and academic tracking.

In a similar manner, the academic orientation of contexts may also influence whether academic achievement boosts self-esteem. A study by Trautwein and colleagues (2006a) compared seventh graders from East and West Germany shortly after German reunification and found effects of academic self-concepts on self-esteem to be stronger in the more achievement-oriented East German system (which emphasized the importance of academic achievement and more strongly valued effort as means to academic success).

Another type of environmental influence during adolescence may be gender-specific socialization. Research has indicated the presence of gender differences in multiple developmental domains (e.g. Baldwin & Hoffmann, 2002, Logan & Johnston, 2010) and confirmed that gender differences emerge when socialization factors begin to exert stronger influences (cf. Baldwin & Hoffmann, 2002) caused by gender-specific expectations. Thus, gender differences in relations between academic achievement, peer acceptance, and self-esteem are also conceivable. For one, the commonly found result that girls report higher academic motivation than boys (e.g. Bugler, McGeown, & St Clair-Thompson, 2015) may also indicate that they evaluate their academic achievement as a more salient part of their self-esteem than boys do. However, although contextual influences on developmental connections during adolescence are conceivable, empirical evidence is largely missing.

The Present Study

Our hypotheses can be summarized as follows. First, we expect to find mutual positive associations between academic achievement, perceived peer acceptance, and self-esteem. We based this prediction on meta-theoretical assumptions about developmental connections (e.g. Baltes et al., 2006; Cicchetti & Curtis, 2007), specific theories about bivariate connections (e.g. Leary & Baumeister, 2000; Juvonen & Knifsend, 2016), and empirical findings (Buhs, 2005, Reitz et al., 2016). More precisely, we expect to find a higher level of self-esteem predicted by peer acceptance and academic achievement, as indicated by sociometer theory (Leary & Baumeister, 2000). We also assume that self-esteem may predict peer acceptance (as implied by self-broadcasting theory, see Srivastava & Beer, 2005) and academic achievement. We moreover expect to find mutually positive relations between perceived peer acceptance and academic achievement (cf., Juvonen & Knifsend, 2016).

Second, we hypothesize that some of these associations may change between early and middle adolescence. We assume that the influence of perceived peer acceptance on self-esteem may increase due to the rising significance of peer relationships (Harter, 2012). Drawing on findings that adolescents place decreasing levels of significance on academic engagement and achievement (Galvan et al., 2011), we expect to find a reduction in the degree to which high academic achievement promotes self-esteem and an increasingly negative relationship between high achievement and peer acceptance.

Third, we expect that some of these mutual associations may differ across gender groups and academic tracking. We expect to find a more positive relation between academic achievement and perceived peer acceptance in the academic school track and a less positive or even negative association in the non-academic tracks. We also expect more positive effects of high academic achievement on self-esteem in the academic track. We base these assumptions on findings regarding higher levels of school motivation and engagement in higher academic tracks (Trautwein et al., 2006b) creating different norms about how adolescents value academically oriented behavior in their peers or themselves (cf., Juvonen & Knifsend, 2016). Since previous findings have indicated gender differences in mean levels and developmental trajectories during adolescence (e.g. Baldwin & Hoffmann, 2002), we explore whether relations between academic achievement, peer acceptance, and self-esteem differ between girls and boys.

Methods

Data

We used a subset of data from the German longitudinal study "Learning Processes, Educational Careers and Psychosocial Development in Adolescence and Young Adulthood" (BIJU; see Schnabel, Alfeld, Eccles, Köller, & Baumert, 2002, for details). The following analyses included data from $N = 7{,}977$ adolescents (female students = 53.0%; age at t_1: $M = 13.5$ years, $SD = 0.68$) from 153 schools (3,672 students on the academically oriented track and 4,305 on the non-academically oriented tracks of German secondary education). Adolescents in our sample came from a variety of educational backgrounds (64.6% of parents [father and/or mother] with at least a high school diploma) and socioeconomic backgrounds (highest socioeconomic status of parents: $M = 49.99$, $SD = 12.62$; Treiman Index; Treiman, 1977). In the present study, we considered three measurement points that covered a shorter time span of a half year and a longer time span of three years: the start of seventh grade in 1991 (t_1), the end of seventh grade in 1992 (t_2), and near the end of tenth grade in 1995 (t_3).

Instruments

Academic achievement. We used three indicators to operationalize adolescents' academic achievement across each measurement point. We used standardized achievement tests from different studies of scholastic achievement in mathematics, English, and physics scaled on a common metric using a Rasch model (for further information, see Becker, Lüdtke, Trautwein, Köller, & Baumert, 2012). The reliabilities of the test scores were between α=.66 and α=.88.

Peer acceptance. We assessed peer acceptance using a set of three items (Fend & Prester, 1986; "When the others do something together at recess, they often don't include me"; "No matter what I do, my classmates don't like me"; "Sometimes I feel like an outsider in my class"; $\alpha_{t1} = .77$, $\alpha_{t2} = .79$, $\alpha_{t3} = .78$) on a four-point Likert scale (1 = *strongly agree*, 4 = *strongly disagree*). Since our scale only used inverted negatively keyed items, we used an additional positively keyed item that was only assessed at the first measurement point ("I have a good standing with my classmates") to prove the validity of our measure. Scale analyses suggested validity indicated by a one-factor-solution, a satisfying scale reliability ($\alpha_{t1} = .72$), and a medium-sized correlation between the positively keyed item and the scale (r =.29).

Self-esteem. We measured self-esteem using a 4-item German version (Jerusalem, 1984; Trautwein, 2003; "At times, I think I am not good at all"; "I certainly feel useless at times"; "All in all, I am inclined to feel that I am a failure"; "I wish often to be another person") of the Rosenberg Self-esteem Scale (Rosenberg, 1965). The participants were instructed to use a four-point Likert scale (1 = *strongly agree*, 4 = *strongly disagree*) to rate how closely the statements applied to them ($\alpha_{t1} = .73$, $\alpha_{t2} = .81$, $\alpha_{t3} = .88$). Former analyses have shown that latent correlations between the short and the long version of the Rosenberg scale in German equal unity (Trautwein, 2003).

Statistical Approach

Missing data. We included in our analyses all those participants with information from at least one measurement point. Students who participated in the entire study ($t_1 - t_3$) differed from students who only participated in the first data collection point in background variables such as gender ($\chi^2 = 19.04$, $p < .001$) and socioeconomic status (up to $d = 0.14$). In such cases, current literature recommends replacing missing data by using multiple imputation (MI, cf. Graham, 2009; Little & Rubin, 2002). Although MI does not rule out parameter bias entirely, it reduces the risk of biased parameter estimations and maximizes test power (cf. Collins, Schafer, & Kam, 2001). We carried out MI using the MICE package (Multiple Imputation by Chained Equations; van Buuren & Groothuis-Oudshoorn, 2011) in the R 2.15.1 software (cf. R Core Team, 2014). We conducted separate imputations for each school type and imputed 10 data sets respectively. The MI model included auxiliary variables on the individual level (English and mathematics grades from the 6th grade, the German state where they lived, their parents' socioeconomic status and level of education) and on the school level (the average socioeconomic status and the average academic achievement in mathematics, English, and physics in the seventh grade).

Analytical strategy. We conducted multi-group cross-lagged panel models that used latent factors stepwise tested for measurement invariance. This proceeding allowed us to investigate structural relationships independent of random measurement error and longitudinal changes in the reliabilities of constructs (Bollen & Curran, 2006). As a basis, we specified a structural model across all measurement points with three latent factors for each point (i.e., one latent factor for each construct) and progressively tested it for measurement invariance (Meredith, 1993; Widaman & Reise, 1997). Please see the online supplemental material for detailed information on the measurement model (Table S2 and Figure S1) and stepwise testing (Table S1). We used objective model fit indices to value the fit of our final models (root mean square error of approximation [RMSEA], comparative fit index [CFI], Tucker Lewis Index [TLI], standardized root mean square residual [SRMR]). CFIs and TLIs above .90 and RMSEAs and SRMRs below .08 typically indicate an acceptable fit to the data (see Hu & Bentler, 1998; Schermelleh-Engel, Moosbrugger, & Müller, 2003). Since we could assume strong factorial invariances across time (RMSEA: .042; CFI: .943; TLI: .935; SRMR: .043; factor loadings and measurement intercepts were constrained to be equal across time points; see, Meredith, 1993), our results are relatively independent of changes in measurement across time. By the same

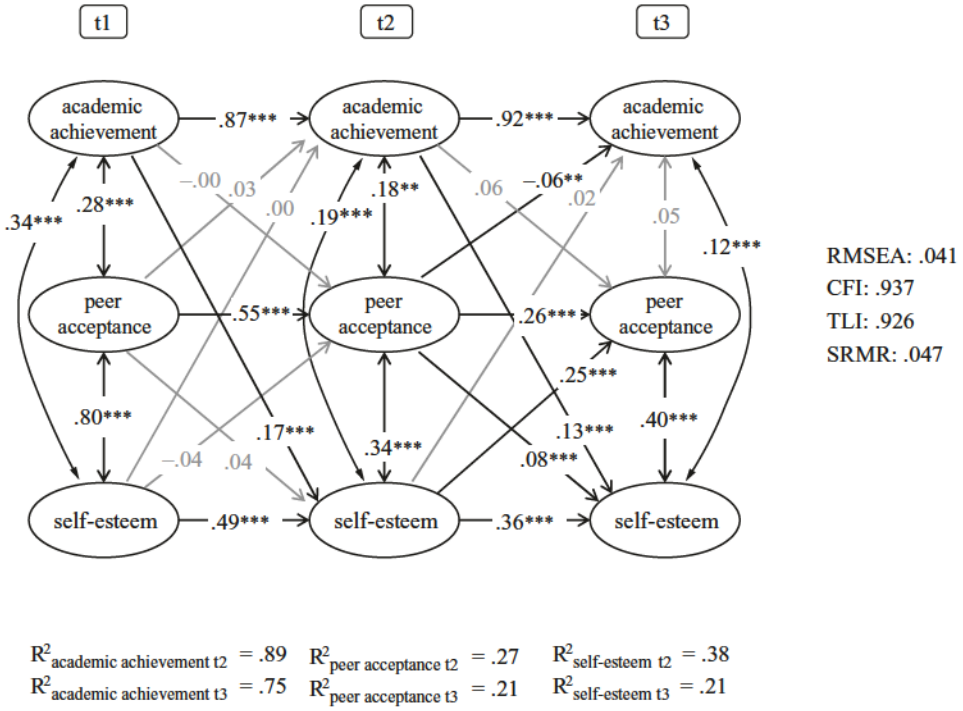

Figure 1. Results of the latent cross-lagged panel model.
Note. $N = 7{,}977$; Confidence intervals can be found in Table S3 in the online supplemental material; *$p < .05$, **$p < .01$, ***$p < .001$.

token, we allowed for correlated residuals of the corresponding manifest items across adjacent time points (Bollen & Curran, 2006). We specified a latent cross-lagged panel model (see Figure 1; Finkel, 1995) to examine longitudinal relations between adolescents' academic achievement, peer acceptance, and self-esteem. We allowed latent factors from earlier measurement points to be predictors of the subsequent measurement point, which meant that we only estimated first-order autoregressive effects and recursive effects between the domains. We also allowed cross-sectional intercorrelations between the domains.

To investigate differential effects by gender and school type, we estimated multiple-group cross-lagged panel models with two school types (academically oriented track vs. non-academically oriented tracks) by two gender groups assuming strong factorial invariance (factor loadings and intercepts were constrained to be equal across time points and groups; correlated residuals of the corresponding manifest items across adjacent time points were allowed to vary between groups; RMSEA: .024, CFI: .939, TLI: .931, SRMR: .054). We compared a model that allowed regression paths (autoregressive effects, recursive effects, and cross-sectional correlations) to vary between all groups with more restrictive models in which regression paths were constrained to be equal for some of the groups. We used the Bayesian Information Criterion (BIC) to compare the relative fit of the models, with lower scores typically indicating a better fit to the data.

We used the software *Mplus* 7.11 (Muthén & Muthén, 1998–2013) for statistical modeling. We considered missing data using the option type = imputation. In the BIJU study, students were chosen using cluster sampling, which involved randomly selecting schools and then taking two full classes per school. We accounted for the hierarchical data structure by estimating all models with robust standard errors (i.e., analysis option type = complex, using school as cluster variable).

Results

Table A.1 in the appendix shows descriptives and correlations for all examined constructs and all three measurement points. Overall, these first results indicated substantial positive connections between adolescents' academic achievement, perceived peer acceptance, and self-esteem. They also hinted at favorable associations between attending the academically oriented track and adolescents' academic achievement, self-esteem, and perceived peer acceptance. Furthermore, the initial results pointed to differences as a function of gender. To examine the developmental significance of these associations more comprehensively, we report our standardized results from structural equation modeling in the following sections.

Relations Between Academic Achievement, Perceived Peer Acceptance, and Self-Esteem, and their Developmental Changes

Figure 1 shows the results of the latent cross-lagged panel model. As hypothesized, we found mutual positive relations: The results indicated medium-sized cross-sectional correlations of academic achievement with self-esteem and perceived peer acceptance at t_1 and a large-sized correlation between self-esteem and perceived peer acceptance. We also found statistically significant longitudinal predictions that differed between early adolescence ($t_1 - t_2$) and middle adolescence ($t_2 - t_3$). We found no reciprocal association between perceived peer acceptance and self-esteem during seventh grade but statistically significant small- to medium-sized positive predictions between t_2 and t_3. However, only the prediction of perceived peer acceptance by self-esteem ($\Delta b = .29$; $p < .001$), but not vice versa ($\Delta b = .04$; $p = .568$), increased statistically significantly across time. As hypothesized, academic achievement

Table 1. Test of invariances in associations by school type and gender.

Model	BIC	*a*BIC
Model 1: I for school type and gender	548,706.187	547,616.203
Model 2a: I for school type, but not gender	548,881.373	547,705.588
Model 2b: I for gender, but not school type	**548,648.141**	**547,472.356**
Model 3: No I for school type or gender	549,023.876	547,676.490

Note. *a*BIC = sample size adjusted BIC; lowest BIC and *a*BIC in bold; $N = 7{,}977$. BIC: Bayesian Information Criterion.

predicted self-esteem with small-sized effects. Contrary to our assumptions, these effects did not change statistically significantly across the measurement points ($\Delta b = -.04$; $p = .564$). We found no prospective effect of self-esteem on academic achievement. Our results also indicated no longitudinal associations between academic achievement and perceived peer acceptance between t_1 and t_2 and no prediction of peer acceptance by academic achievement between t_2 and t_3. However, in accordance with our hypothesis, the prediction of academic achievement by peer acceptance became negative between t_2 and t_3, though this decrease reached no statistical significance ($\Delta b = -.09$; $p = .191$).

Differences in Effects by Gender and School Type

In examining whether our results hold across gender and academic tracking, our data favored a multi-group model that constrained parameter estimations to be equal between girls and boys but indicated differential relations between school types (academically oriented track vs. non-academically oriented tracks), as suggested by the lowest BIC (see Table 1). Although the overall pattern of results was comparable, there were some differences between students on the academically oriented and students on the non-academically oriented tracks (for details, please see Table S3 in the online supplemental material). Contrary to our hypotheses, the prediction of self-esteem by academic achievement between t_2 and t_3 ($\Delta b = .10$; $p < .001$) was more pronounced in students on the non-academically oriented school tracks. In accordance with our hypotheses, perceived peer acceptance at t_2 predicted lower levels of academic achievement at t_3 in students on the non-academically oriented tracks, but not in students on the academically oriented track. However, differences in parameter estimations were not statistically significant ($\Delta b = .04$; $p = .198$).

Discussion

The purpose of this study was to investigate the interplay between academic achievement, self-esteem, and perceived peer acceptance during early and middle adolescence, taking into account gender and academic school tracking. The results offer several important findings.

Connecting Academic Achievement, Perceived Peer Acceptance, and Self-Esteem During Early and Middle Adolescence

From a global perspective, we found considerable associations between academic achievement, peer acceptance, and self-esteem that were mainly positive in nature, indicating that developments in these different areas can serve as resources for each other. As can be seen, the results agree with meta-theoretical assumptions of mutual developmental connections (e.g. Cicchetti & Curtis, 2007) and propositions made by developmental task theory (Havighurts, 1972). They therefore highlight the usefulness of a more global and holistic view (cf. Magnusson & Stattin, 2006) on developmental processes during this important life period. Addressing longitudinal connections, our findings underline the assumption that developmental relations may change across developmental states. These agree with the lifespan perspective (Baltes et al., 2006), showing that the kind and strength of developmental connections can change due to developmental status and pressure, and emphasizing the need for developmentally sensitive approaches. In the following, we will discuss central aspects of these results:

As hypothesized, we found that self-esteem was a consequence of academic achievement and peer acceptance. This result is in line with sociometer theory (Leary & Baumeister, 2000), which views self-esteem as an internal monitor that is sensitive to changes in peer acceptance and may also be sensitive to social feedback from parents and teachers following academic attainment. It also agrees with the assumption that the crucial developmental task of identity formation (Havighurts, 1972; Erikson, 1968) may require self-relevant information from different sources for building a global self-view, and replicates recent empirical findings (Reitz et al., 2016; Trautwein et al., 2006a). In turn, our findings also support the prediction made by self-broadcasting theory (Srivastava & Beer, 2005) that self-esteem influences social acceptance. Following this assumption, adolescents with higher levels of self-esteem may interpret social cues in more favorable ways, helping them to be better liked by others. This result also replicates recent findings by Reitz and colleagues (2016), who found that self-esteem predicts adolescents' self-perceived peer acceptance.

Also in line with our hypotheses, the connection between self-esteem and perceived peer acceptance changed from early to middle adolescence. Since we found no longitudinal associations during the seventh grade, mutual positive relations seemed to arise during adolescence. The marginal (but not statistically significant) increase in the prediction of self-esteem by perceived peer acceptance may result from the growing importance of peers' social feedback in adolescents' self-concepts (cf. Harter, 2012). In turn, an explanation for the considerable increase in the prediction of perceived peer acceptance by self-esteem may be that the combination of a more positive interpretation of social cues and more confidence in social interactions increases in impact during these years when peer relationships increase in importance.

Contrary to our hypotheses, we found that self-esteem does not predict academic achievement. This result contradicts theoretical assumptions stating that individuals with high self-esteem have higher academic aspirations and persist despite failure (Baumeister et al., 2003; Swann et al., 2007). However, it mostly agrees with previous research that only found slight effects of self-esteem on standardized achievement scores (Trautwein et al., 2006a). One explanation for this finding may lie in our usage of a global and very stable indicator for academic achievement that offered only little unexplained variance. It may be the case that self-esteem does not promote academic development on the whole but helps students to overcome more situational and subject-specific problems that prevent them from reaching their academic potential. Additional analyses that rebuilt our overall model for each achievement domain separately (English, mathematics, physics) confirmed this assumption by showing prospective effects of self-esteem on the

respective achievement scores in each of the three domains (see Figure S2 in the online supplemental material).

Contrary to our hypotheses, perceived peer acceptance did not predict academic achievement during seventh grade. Our results, therefore, fail to support theoretical assumptions and empirical findings indicating that peer acceptance fosters school engagement and thereby promotes academic achievement (cf. Juvonen & Knifsend, 2016; Véronneau et al., 2010). However, and in accordance with our hypotheses, we found developmental changes in this relation. Higher peer acceptance slightly predicted lower academic achievement during middle adolescence. This developmental change toward an increasingly negative relation can be explained by a decline in school engagement during these years producing an increasingly negative social value of academic achievement (Galvan et al., 2011). One explanation for the missing effect during the seventh grade may be that the change from positive effects in childhood (in our study indicated by a positive cross-sectional correlation at t_1) to negative effects in middle adolescence may take place during early adolescence and may be detectable at that time as no effect.

In addressing the reversed relation, academic achievement did not predict peer acceptance. Although previous studies showed that students generally value academic achievement (Wentzel et al., 2010), this relation should also be affected by the in-progress decrease in school engagement and increase in the negative social value of academic achievement. Another reason for this contradictory finding may be our operationalization of academic achievement. Although standardized achievement scores represent objective academic achievement measures and therefore represent adolescents' academic achievement in an appropriate way, more subjective measures (e.g. teacher ratings, as used by Véronneau and colleagues, 2010) may be more directly noticeable by their classmates and are thus more prone to influence peer acceptance.

Finally, we found substantial cross-sectional connections over and above the longitudinal relations described above. One explanation could be the influence of other salient contexts (e.g. friendships with peers outside school, parents) or other maturational changes (e.g. intelligence development) that indirectly produce cross-sectional connections. Moreover, cross-sectional relations may also result from mutual influences between developmental areas in younger adolescents and also hint at developmental changes in the relations between these constructs.

Schools and Gender as Contextual Influences During Adolescence

Our results also suggest the developmental significance of contextual influences. We found differences in relations between academic tracks. This is in line with previous research emphasizing the crucial role of academic tracking in adolescent development (e.g. Becker et al., 2012), and supports calls to integrate a contextual view in studying individual developmental processes (Bronfenbrenner, 1979). Nevertheless, we found only slight differences.

In line with our hypothesis, perceived peer acceptance predicted lower levels of academic achievement in the non-academic, but not in the academic school track (even if differences in parameter estimations were not statistically significant). More negative peer norms regarding academic achievement in lower achieving peer groups may prompt adolescents to decrease or hide school engagement to avoid social exclusion (Juvonen & Knifsend, 2016). However, the results did not support some of our predictions regarding the effects of academic tracking. We found no differential predictions of perceived peer acceptance by academic achievement. Opposite to our predictions, academic achievement predicted self-esteem more strongly in the non-academic, compared to the academic, track. Since our predictions relied mostly on classroom norms, the differentiation of academic norms between classroom contexts, rather than school types, may be more likely to confirm these assumptions.

We found no differences in effects for girls and boys. Though a broad empirical foundation confirms differences in how girls and boys generally accomplish developmental tasks and how developmental trajectories progress across adolescence (e.g. Baldwin & Hoffmann, 2002), intra-individual relations between age-salient tasks seem to be largely gender invariant. However, the relation of academic achievement with peer acceptance and self-esteem may vary between girls and boys for different academic areas subject to different gender stereotypes. For example, our descriptive results suggested higher academic achievement for boys than girls at t_1 and t_3, but a reversed pattern at t_2. Additional descriptive analyses indicated that this pattern was partly caused by a higher likelihood of girls attending the academic track, but may also partly result from differential and gender-specific development in mathematics, English, and physics. We therefore estimated additional analyses for our overall model for each achievement domain separately. These analyses confirmed the gender-invariance of the connections (for details, see Figure S2 and Tables S4 and S5 in the online supplemental material).

Limitations and Outlook

This study had many advantages compared with previous research: the large sample size, the longitudinal design, the joint analysis of age-graded tasks and contextual influences. However, the study's methods also had limitations.

First, our data involved an oversampling of students on the academically oriented track of Germany's secondary system and thus represents adolescents with an above-average socioeconomic background. Although we controlled for these factors in the multigroup model, and the indication for differential relationships was only moderate, we cannot rule out that this influenced the generalizability of our overall results. Second, previous studies have suggested that self-perceptions and peer ratings are both important, and have emphasized the mediating role of self-perceived peer acceptance (e.g. Reitz et al., 2016). However, since it seems plausible to assume that people who generally see themselves in a more positive light will also interpret their peers' reactions to them more positively, the observed relations between peer acceptance and self-esteem may be partly attributable to the chosen form of operationalization. Third, although our results prove the assumption of longitudinal connections between constructs, cross-lagged designs do not provide evidence for causality, and future intervention studies should address this issue and the underlying mechanisms. Fourth, since the timeframes between our three measurements differed largely (less than one year vs. three years), it is also possible to view the differential results between t_1 and t_2, and t_2 and t_3, respectively, from a perspective on short- vs. longer-term effects rather than expecting age-graded changes. It might, therefore, be possible that smaller short-term effects may mutually cumulate their influence over time and, thus, may only be detectable over

longer time spans. For example, a high self-esteem may only affect perceived peer acceptance when it manifests itself in persistent behavior over a longer time span, in turn reinforced by increasing perceived peer acceptance. However, the cohort-sequential design of our study does not allow us to disentangle the view on short- vs. longer-term relations from age effects in our data. Finally, comparing our results between academic tracks and genders raises the methodological challenge of disentangling the effects of selection and socialization. Thus, we cannot rule out that initial mean-level differences in academic achievement, peer acceptance, or self-esteem between academic tracks (or gender groups) may impede the comparison of longitudinal relations between academic tracks (or gender groups).

Conclusion

To the best of our knowledge, this study is the first to examine the link between academic achievement, self-esteem, and peer acceptance by incorporating school tracking and gender groups. In general, we find positive associations between these age-salient constructs indicating that developments in these different areas can serve as resources for each other. The results argue for a comprehensive and global view on and promotion of adolescent development. Our findings also indicate an influence of maturational changes and contextual influences and therefore emphasize the need for a developmentally sensitive approach and the integration of contextual influences in the research on adolescent development.

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Supplemental material

Supplementary material for this article is available online.

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Appendix

Table A.1. Mean Levels, Standard Deviations, and Correlations.

	Latent Construct	*M*	*(SD)*	1	2	3	4	5	6	7	8	9	10	11
1	Academic achievement t_1	−0.52	(0.75)	1										
2	Academic achievement t_2	−0.43	(0.97)	.90	1									
3	Academic achievement t_3	0.68	(0.92)	.91	.83	1								
4	Peer acceptance t_1	2.93	(0.58)	.28	.27	.23	1							
5	Peer acceptance t_2	2.96	(0.63)	.16	.20	.14	.50	1						
6	Peer acceptance t_3	3.06	(0.58)	.19	.18	.18	.43	.38	1					
7	Self-esteem t_1	2.79	(0.64)	.29	.25	.27	.79	.38	.38	1				
8	Self-esteem t_2	3.04	(0.70)	.37	.41	.35	.47	.47	.37	.55	1			
9	Self-esteem t_3	3.18	(0.73)	.25	.23	.27	.35	.27	.51	.41	.42	1		
10	Gender	0.47	(0.50)	.07**	−.08**	.08	−.07*	−.11	−.06**	.11	−.04***	.09	1	
11	School type	0.46	(0.50)	.72	.75	.73	.23	.12	.13	.19	.25	.10	−.10*	1

Note. Gender: 0 = female, 1 = male; School type: 0 = non-academically oriented track, 1 = academically oriented track; Possible ranges are 1–4 for self-esteem and peer acceptance with higher values indicating higher self-esteem and higher peer acceptance; Indicators for academic achievement were scaled on a common metric using a Rasch model; $N = 7{,}977$; $p < .001$, **$p < .01$, *$p < .05$, ***not statistically significant.